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ABSTRACT

The authors' experiences with electronic bulletin boards are recounted. Begun in 1986, the Physics Forum bulletin board for Massachusetts high school physics teachers spent its first few years as a resource of limited use only. In 1989, however, the National Science Foundation awarded the Five Colleges/Western Massachusetts Partnership a grant which facilitated the transformation of the Physics Forum to the SpaceMet network, which features electronic mail capabilities along with downloadable files and a searchable database. Another development has been the UMassK12 Internet bulletin board for Massachusetts K-12 educators and students. Issues and details about connectivity are discussed in light of the fact the UMassK12 can support 100 concurrent modem callers and that usage is increasing. Several examples of bulletin board messages are provided. (BEW)

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Telecommunications: From the Physics Forum to SpaceMet to UMassK12

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Abstract

The PC based Physics Forum bulletin board started in 1986 led to the SpaceMet network and the UMassK12 Internet service. The menu-driven UMassK12 system supports 100 concurrent callers; daily usage went from 100 to 700+ calls in 6 months. Teacher training and support have been critical. Dial-up locations around the state make access free or inexpensive. A leased line to Franklin County Tech School provides Internet access via its LAN and dial-up lines.

Introduction

We have been involved with educational bulletin boards (bbs) since 1986. The original PC based bbs, the Physics Forum, evolved into the SpaceMet bbs network. A new system, UMassK12, provides full Internet services for Massachusetts

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K12 educators and students. We will describe the growth and characteristics of these systems and also address issues of training and access.

The Physics Forum

When the University of Massachusetts announced a small telecommunications grant program, we proposed starting a bbs for Massachusetts high school physics teachers. Physics teachers are generally isolated and often poorly trained, and we hoped to bring them the resources of UMass and of the teaching community. Operation began in May, 1986, with an AT clone running Fido software in two multitasking (DesqView) windows. Access was available via a local phone number, an 800 number, and a leased line from the Boston campus, 100 miles away.

The Physics Forum was an excellent bbs, with conferences devoted to science, education, computers, and related areas, with and collections of physics teaching materials. However, despite extensive publicity, usage was far less than we had anticipated—a few calls per day.

Physics teachers had limited access to computers and telephones; modems were an expensive novelty. Given the logistical problems and the full daytime schedule teachers faced, the low level of utilization was understandable. In fact, just about every other educational bbs venture started then had a similar experience. Soon we welcomed all teachers and students interested in science or computers. We publicized the system using teacher newsletters and spoke at conferences and workshops. Gradually usage grew.

SpaceMet

In 1989, the National Science Foundation awarded the SpaceMet middle school science teaching enhancement grant to the Five Colleges/Western Massachusetts Partnership, which links area schools and Amherst, Hampshire, Mount Holyoke and Smith Colleges and the University of Massachusetts. SpaceMet helped middle school science teachers to use space exploration to interest students in science and technology. The Physics Forum became the SpaceMet network of three 386's running Maximus bbs software under DesqView. Each computer had two to four phone lines, and they were located to provide local phone call access to nearly all of our project participants and their classes; the Boston and 800 line connections were continued.

Messages entered on any SpaceMet bbs "echoed" to the others. Teachers and their students used the system to share ideas and information about the SpaceMet project and also to communicate with their peers elsewhere in the world.

In 1991 we added a 486 with an eight serial port "Digiboard" and connected it via an Emulex terminal server to the Internet. We also placed a half dozen bbs on XT's in classrooms. These allow students to access echoes locally without tying up our ports except during brief mail transfers. The system now has over 3000 users, receives up to 300 daily calls, and is part of the NSF Five College Education in the Earth's Environment, Ecology, and Energy Project (5C/5E).

Anyone is welcome to use SpaceMet Central (413-545-4453) or SpaceMet Internet (spacemet.phast.umass.edu), not just SpaceMet or 5C/5E teachers and their students. This wider community enhances the system and includes many of our most energetic and innovative participants. The echomail connections to teachers and children around the world add an additional dimension to the telecomm experience. There are conferences related to our own NSF projects and other regional teacher and community projects. We have the forty or so echomail areas and project channels of K12Net, a system of 500+ educational bulletin boards, and a selection of FidoNet conferences. (FidoNet links over 25,000 microcomputer based bulletin boards located around the world.) The 3000+ files available for downloading include text files—teaching materials, NASA space and astronomy data, ERIC abstracts, environmental science information—plus educational shareware programs. We have a searchable database based on these documents and on calendars of events, etc.

We have sought throughout to provide a stimulating and varied telecommunications resource to the teachers and students of our area and of Massachusetts. Connections to SpaceMet and UMassK12 are now available via the five campuses of the University, Mount Holyoke College, and several state and community colleges connected to the MassNet network.

SpaceMet Internet

Experienced callers are often surprised to telnet over the Internet to a Maximus bbs and ask how we accomplish this. As noted earlier, users access a Emulex terminal server. This is a $1500 box that looks like a modem to a serial port on our 486. This setup works but has definite limitations. Running 8 or more windows under DesqView, even on a 66 MHz 486, often leads to delayed or jerky responses. Probably a true multiuser bbs program such as TBBS would solve this problem. More serious is the inability of our users to do file transfers over the Internet. ZModem, XModem, etc., all fail more often than not. Only Kermit works reliably over the Internet, and Maximus does not support this protocol.

Terminal servers and multiport boards represent an expensive and clumsy way to bridge the Internet and MS-DOS worlds. Users cannot telnet out of the system to access the riches of the Internet, nor can they use the standard Internet File Transfer Protocol (FTP). Running a pure Internet system instead makes a lot of sense.

Issues in Internet access for K12

We had originally not put our educational telecommunications service on a mainframe or minicomputer because of their generally awful user interfaces. Until recently, nothing comparable to the many excellent microcomputer bbs programs existed for Vaxes and the like. Nevertheless, the lure of the Internet became increasingly hard to resist. We wanted our users to have the opportunity to explore the thousands of public access sites offering an incredible range of information resources, and looked for appropriate ways to make this possible.

In making Internet access available to teachers and students, three key factors must be kept in mind.

- You can't just provide a naked $ or % prompt; teachers and students need help and guidance in locating resources and exploiting the system. A good menu based interface is essential.
- Students cannot be allowed free access to materials considered inappropriate for minors. The organizations providing Internet connectivity are understandably concerned that such access be avoided. A menu based system can control what students may reach and deal with this "social liability" issue. User agreements and parental consent forms are additional safeguards for the providers.
- Schools have limited computer resources; demanding specific terminal capabilities excludes many potential users. A survey of 116 5C/5E project teachers found the following numbers for access to computers at school and at home:

Computers Available to Western Massachusetts Teachers

School	#	%	Home	#	%
IBM/clone	38	33	IBM/clone	29	25
Mac	24	21	Mac	12	10
Apple II	88	76	Apple II	23	20
Other	3	3	Other	5	4
None	2	2	None	47	41

School percentages total more than 100 because of multiple platforms. The Apple II is most common, and half the teachers in the survey had ONLY Apple II's in school. At home, it was IBM or clone, Macintosh, and Apple, in that order, with 59 percent of these teachers having some kind of computer. Clearly, if we require Macintosh or Microsoft Windows user interfaces, we exclude much of our target audience.

The UMassK12 system

The University Computer Services (UCS) agreed to help in creating an Internet bulletin board for Massachusetts K12 educators and students by purchasing a DEC Ultrix workstation, a model 5000/133. This computer has 48 Mb of ram and 3 Gb of disk storage, and can handle 100 concurrent user sessions.

We decided to use the FreePort program developed for Cleveland FreeNet, a popular public access Internet bbs. This software is definitely low tech—you can access it with a dumb terminal—although the message editor and some connections to the outside world such as the gopher service require VT100 emulation. File transfers requires that the terminal also support Kermit. VT100 and Kermit are both provided by many MS-DOS and Macintosh shareware and commercial communications packages, and by one Apple II commercial program, ProTerm.

Inexperienced users find the FreePort layers of menus easy to understand, and go xxxx shortcuts make it efficient for experienced users. The use of similar interfaces for mail and newsgroups is a good feature. The software runs under UNIX, but users do not need to know anything about UNIX except that the commands are often case-sensitive. Our programmer has modified the original FreePort package extensively to run properly under Ultrix and to fit our tastes and needs.

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Our Internet bbs, UMassK12 (k12.ucs.umass.edu; login: guest) has been operational since May, 1993. We have held workshops for up to 40 people at once, and the system response has been instant and flawless. Both experienced and novice users find UMassK12 a comfortable environment. ("The best system I've seen" according to one experienced user.) Computer interfaces that are easy to learn do not automatically have enough functionality to allow for ease of use in performing a variety of tasks. We apparently have successfully balanced the two requirements with our simple but logical menus, help screens, manuals, and training materials.

UMassK12 menus

On UMassK12, teachers have full Internet access, while students are limited by the menus to specific sites and functions. The range of services we offer is suggested by the Main Menu:

```
1  User Settings and Information
2  Bulletins
3  Electronic Mail
4  Newsgroups
5  Local Resources
6  UMassK12 Gopher
7  Connections to Other Services
8  Personal Files
9  Help Desk
10  Access Phone Numbers for UMassK12
11  Send Mail to Sysop
```

The first menu choice leads to configuration options, account application forms, and information about the system. Bulletins include announcements of workshops and other local events. Electronic mail provides the usual range of Internet E-mail options, including signature files, aliases, mail forwarding, etc.

Our philosophy is apparent in the Newsgroup option. We carry a substantial fraction of the usenet newsgroup backbone, but include only groups that are appropriate to a school environment. These are grouped logically in menus to facilitate access. We also gate our own SpaceMet echoes and some FidoNet echoes to local newsgroups using the UFGATE program. This links our older SpaceMet network with the new UMassK12 system.

Local Resources allows users access to extensive collections of information about telecommunications, science, and other academic areas. The K12 Gopher is configured so that students can access a wide variety of gopher services, but never reach a menu item offering "All the Gophers in the World." Connections to Other Services guides users to specific telnet sites and also provides teachers full gopher, telnet, and FTP services. Personal Files allows users to upload and download files, edit them, send them to others, etc. Help Desk and Access Numbers provide additional information. Mail to Sysop encourages feedback and asking for assistance.

Training

Teacher support is critical for educational telecommunications. Teachers are not computer hobbyists or professionals. They need training programs, well written manuals and help screens. They need help, on site, on-line, and via telephone, both with the technical aspects of telecommunications and with its effective utilization in the classroom. Anyone planning an educational telecommunications service must budget realistically for this support.

When we obtained our NSF SpaceMet science teacher enhancement grant in 1989, we began formal teacher training in the use of the bbs. After our first year of the SpaceMet project we developed procedures that work well for us. We did one-on-one introductions to telecomm with our project participants in the spring. During the three week summer institute, they completed worksheets covering all the aspects of the system. We continued to provide support during the following year while they worked with their students on the academic year components of the project.

Training for UMassK12 is simplified by its 100 concurrent user capacity which makes it possible to do large workshops using terminal rooms. Worksheets take users through configuring their accounts, bulletins, electronic mail, newsgroups, local resources and gopher. Advanced topics for users with some background (or for a second session) include aliases, signature files, telnet, and FTP. Participants progress at their own pace, asking for help when needed. One staff member per 5-8 participants works well. Given the simplicity of the user interface and the clarity of the manual, even telecommunications neophytes make rapid progress. Approximately 500 teachers have attended workshops up to February, 1994, and the response to the workshops and the system has been extremely positive.

Projects

Local and national or international projects are a key feature of SpaceMet and UMassK12. K12Net projects are available in both systems. UMassK12 also offers Kidlink and other Internet based projects. Western Massachusetts teachers have undertaken local projects with their students sharing stream and weather data and other classroom research information.

It is important to offer guidance in developing applications. Teachers are a great source of ideas, but they often need help in defining realistic telecommunications projects, in locating participants, and in exploiting the technology. Telecommunications projects require a critical mass of people who have agreed to participate, a good leader or facilitator, and a realistic time line. Simple projects which allow flexibility in implementation often work best.

Some examples

The following messages are from various projects that were active last year on our bbs and on others around the world. They illustrate the value of telecommunications in the classroom. The first is from a teacher in our 5C/5E streams research community. Each class tracked characteristics of a local stream and observed its insect life. They shared their data and determined regional patterns.

```
From: Betsy Koscher
To: Ryan Road
Subj: data from stream
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The class found several caddis fly cases and a stone fly
case. They caught minor water striders and several yet to be
identified bugs... This is our data:
1. date 4/30/93
2. school Chapin Street
3. teacher Mrs. Koscher
4. stream Harris Brook
5. precipitation-none for two days
7. pH stream-7.0
8. Temp air-69F, 20C|
9. Water temp-53F, 12C
10. Nitrates-none present
15. velocity-56r/min
16. hardness-3 mg/g
17. turbidity-light pale clear yellowish green floating sand
here and there
18. discharge-haven't figured it but it was much less than
just last Tuesday when it was 5 inches deeper and 12 r/min
faster. We think it is because it rained last Monday and
didn't rain before Friday.
```

* Origin: SpaceMet South (Holyoke, MA) (1:321/302)

Two junior high classes in the 5C/5E project exchanged write-ups of their independent research projects and then communicated electronically about their findings.

```
From: Hawks Rule
To: FRONTIER THREE
Subj: MEAGAN BARONAS
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```
The major findings when i did this investigation were that
popsecret popped the fluffiest then jollytime, act 2 lite
natural, act 2 lite butter, and last popquiz. Is this what
you found?
                    THANKS, JEN KENNEDY
```

* Origin: SpaceMet-North Greenfield, MA (1:321/152)

Currently we are supporting an unusual intergenerational community based project that links middle school children and elderly people in nursing homes and senior centers. Here is a typical message.

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From: Michele Hebert
To: Vi Osborne
Subj: Hello!

Hi! We are Joe, Andrea C., Krystal, and Tony. We love poetry and we hear that you do to! We want you to be our Team Leader. We are looking forward to meeting you soon so... GET WELL SOON. Write back to Liberty School.

K12Net's Global Village News is an example of a very simple project concept that works really well. Moderator Lorna Kropp in , Spokane, Washington asked participants to "post the information about your community and then look for other news and compare the kinds of celebrations. Are there any patterns? Any celebrations dependent on geography, climate or cultural heritage? What other questions can you ask?"

From: Elizabeth Probert
To: Lorna Kropp
Subj: Global Village News

Several class members wanted to tell though of how life is different here in winter so:

Shannon S writes: My life is affected by the sport I do. In summer I compete on my horse in competitions and play summer netball and tennis and go swimming. In winter I play indoor soccer and soccer and do all the winter dressage and show jumping series on my horse....

Rochelle says: School life is different because it is a lot colder and finding a seat at lunchtime is a lot harder as the grounds are wet and everyone is wanting to sit on a bench.

[teacher-in most of NZ, students bring lunch to school or buy it at the Tuckshop. There is no cafeteria though or covered place for eating lunch. If it is wet at lunchtime in our school, students eat lunch in classrooms and we have a short lunchtime and go home a bit earlier.]

The K12Net MathMagic project invites classes to tackle unusual math problems:

From: Chris Riley
To: all
Subj: Mathmagic problem grade 7/8

Our names are Lori Moreno, Chris Riley, Howard Mancillas. We are from Indian Ridge Middle School in El Paso,Texas. A cassette tape has 2 sides A&B. There are 9 songs. The length of each songs are 1)2:30, 2)1:50, 3)4:25, 4)3:25, 5)2:48, 6)3:00, 7)2:27, 8)3:27, 9)4:10. Now we must schedule the songs in the most efficient manner. We must arrange it to use as little tape as possible. There must be 3 seconds of silence between them.

We need to find the total length of minutes & seconds. We need to know what songs are on side A &B to reduce the amount of tape needed. We need to know what is the difference in the amount of time music plays on each side of your arrangement.

For #1 we had to add up the minutes first then we added up all the seconds and divide by 60. To find out what songs

were on side A & side B we picked random songs and added
then up to see what was the closest arrangement to 14 min.
We found the closest arrangement which was 14 &14.

* Origin: Hawks K12Net, El Paso, (1:381/105)

The Internet-based Kidlink projects annually involved about 10,000 children aged 10-15 in fifty countries. They tell about themselves in a specific format and then take part in activities such as a conference on Children's Rights:

From: UBJVM6Q@aster.ccs.bbk.ac.uk (MIKE BURLEIGH)
Subject: *UNICEF Information project: Children's Rights
Date: Sun Sep 12 09:25:00 1993

The Castelnau kids from England have been talking about our idea of children's rights. We think kids all over the world should have these rights, regardless of race, religion, physical or mental ability. Here they are:

The right to an education,
The right to clean water,
The right to enough food,
The right to a safe home,
The right to be loved,
The right to say what they feel and be heard,
The right to war rehabilitation,
The right to not be involved in or affected by armed conflict,
etc....

Leased line Internet access

Up to now most of our access has been via dial-up: one modem and phone per user. This does not scale very well, since the number of lines available in a school is necessarily limited. Especially in departmentalized schools, teachers find it difficult to make effective use of a resource that only one or a few students can access at a time. However, many schools are installing local area networks (LANs). Connecting LANs to the Internet makes it possible for many students or teachers to have simultaneous Internet access. Depending on the local phone rates, a leased line may cost as little as four ordinary dial-up lines while offering the possibility of concurrent access by 20+ users. It also makes available graphical interfaces such as Mosaic which require direct network connectivity.

In order to explore the LAN connection, we obtained a supplement to our NSF grant that covers most of the costs for one test site for two years. We selected Franklin County Tech School as the test site because of its strong computer technology program. Also, since all of Franklin County is a single toll free area, a modem pool there provides free Internet access to a large area.

We describe this setup in some technical detail for the benefit of those considering similar connections. A 56 kb synchronous dedicated line connects Tech and UMass. A NAT router ($1600) at Tech controls the feed into this system and a CISCO router ($3350) is utilized at the UMass end. At Tech, a thin ethernet backbone provides connectivity between the Novell 3.11 LAN within the school and the Xyplex terminal server ($2000) which connects the dial-up lines to the NAT router. All dial-up modems are stand-a-lone US Robotics V.32bis modems ($300 each) with their ports locked at 19.2 kb. The Novell network is using "LAN Workplace for DOS" and connects via Novell's Open Datalink Interface (ODI) and is implemented on 486SX machines running Windows 3.1. We estimate that this system can support 20 to 25 simultaneous users without serious performance degradation.

Total startup cost, including installation of the leased and dial-up lines but not labor, was approximately $11,000. Since the 56 kb dedicated line is being used for Internet connectivity, a substantial amount of traffic is for Inter-LATA communications and thus qualifies for the Federal FCC-1 Tariff. This reduced installation costs from $1,000 to $300. A multi-year contract provided a discount on the monthly charges. Leased line charges consist of fixed fees plus a modest mileage component, so that costs rise only gradually with the distance. We pay $1.90 per mile, so the $180 monthly bill for our 12 mile line has a $22.80 mileage component.

Annual costs are about $3000 for the leased line plus dial-ups; estimated repairs and maintenance are $500-1000. The University donates Internet access; if we had to pay the regional Internet provider, that would add approximately $10,000.

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